

We claim:

1. A method of synthesizing an unstructured nucleic acid, the method comprising steps of:
providing a nucleic acid template including a first sequence element and a second
sequence element that is substantially complementary to the first sequence element;

providing nucleotide precursors sufficient to synthesize an unstructured nucleic acid
including a first complementary sequence element and a second complementary sequence
element, complementary to the first and second sequence elements, respectively, which nucleic
acid precursors include pairs of complementary precursors that are unable to hybridize with
one another; and

contacting the template and precursors with an enzyme characterized by an ability to
polymerize the precursors under conditions and for a time sufficient for incorporation of the
precursor pairs into the unstructured nucleic acid so that said first complementary sequence
element and said second complementary sequence element of the unstructured nucleic acid do
not interact with one another.

2. The method of claim 1, wherein the step of providing nucleotides comprises the step of
providing at least one nucleotide having a purine analog and at least one nucleotide having a
pyrimidine analog such that said purine analog and said pyrimidine analog are not capable of
forming a stable hydrogen bonded base pair.

3. The method of claim 1, wherein the step of providing nucleotides comprises the step of
providing nucleotides selected from the group consisting of: 2-aminodeoxyadenosine 5'-
triphosphate, 2-thiodeoxythymidine 5'-triphosphate, deoxyinosine 5'-triphosphate,
deoxypyrrrolopyrimidine 5'-triphosphate, 2-thiodeoxycytidine 5'-triphosphate, deoxyguanosine
5'-triphosphate, deoxycytidine 5'-triphosphate, deoxyadenosine 5'-triphosphate,

deoxythymidine 5'-triphosphate, and combinations thereof.

4. The method of claim 1, wherein the step of providing nucleotides comprises the step of providing nucleotides selected from the group consisting of: 2-aminodeoxyadenosine 5'-

triphosphate, 2-thiodeoxythymidine 5'-triphosphate, deoxyinosine 5'-triphosphate,
5 deoxypyrrrolopyrimidine 5'-triphosphate, and combinations thereof.

5. The method of claim 1, wherein the step of providing nucleotides comprises the step of providing nucleotides selected from the group consisting of: 2-aminodeoxyadenosine 5'-triphosphate, 2-thiodeoxythymidine 5'-triphosphate, deoxyguanosine 5'-triphosphate, 2-thiodeoxycytidine 5'-triphosphate, and combinations thereof.

6. The method of claim 1, wherein the step of providing nucleotides comprises the step of providing nucleotides selected from the group consisting of: 2-aminodeoxyadenosine 5'-triphosphate, 2-thiodeoxythymidine 5'-triphosphate, deoxyguanosine 5'-triphosphate, deoxycytidine 5'-triphosphate, and combinations thereof.

7. The method of claim 1, wherein the step of providing nucleotides comprises the step of providing nucleotides selected from the group consisting of: deoxyinosine 5'-triphosphate, deoxypyrrrolopyrimidine 5'-triphosphate, deoxyadenosine 5'-triphosphate, deoxythymidine 5'-triphosphate, and combinations thereof.

8. The method of claim 1, wherein the step of providing nucleotides comprises the step of providing nucleotides selected from the group consisting of: 2-thiodeoxycytidine 5'-triphosphate, deoxyguanosine 5'-triphosphate, deoxyadenosine 5'-triphosphate, deoxythymidine

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~~5'-triphosphate, and combinations thereof.~~

9. The method of claims 1-8, wherein the step of contacting with an enzyme comprises with an enzyme selected from the group consisting of: an RNA polymerase, a DNA
5 polymerase, a reverse transcriptase, a ribozyme, and a self-replicating RNA molecule.

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- ~~10. The method of claim 1, wherein the unstructured nucleic acid is used in a ligase assay, a polymerase extension assay, or a nucleic acid array.~~

11. An unstructured nucleic acid with reduced secondary structure relative to a nucleic acid of substantially identical nucleotide sequence having naturally occurring bases, wherein the unstructure nucleic acid has at least two sequence elements that are substantially complementary, wherein the substantially complementary sequence elements do not form intramolecular base pairs, wherein at least one sequence element of at least two complementary sequence elements is capable of hybridizing to a substantially complementary sequence in another nucleic acid molecule.

12. The unstructured nucleic acid of claim 11 comprising nucleotides selected from the group consisting of: 2-aminodeoxyadenosine 5'-triphosphate, 2-thiodeoxythymidine 5'-
20 triphosphate, deoxyinosine 5'-triphosphate, deoxypyrrrolopyrimidine 5'-triphosphate, 2-thiodeoxycytidine 5'-triphosphate, deoxyguanosine 5'-triphosphate, deoxycytidine 5'-triphosphate, deoxyadenosine 5'-triphosphate, deoxythymidine 5'-triphosphate, and combinations thereof.

- 25 13. The unstructured nucleic acid of claim 2, wherein the nucleic acid is synthesized by an

enzyme.

14. The unstructured nucleic acid of claim 13, wherein said enzyme is selected from the group consisting of: an RNA polymerase, a DNA polymerase, a reverse transcriptase, a ribozyme, and a self-replicating RNA molecule.

15. The unstructured nucleic acid of claim 11, wherein the nucleic acid is at least 40 nucleotides in length.

16. The unstructured nucleic acid of claim 11, wherein the nucleic acid is at least 100 nucleotides in length.

17. The unstructured nucleic acid of claim 11, wherein the nucleic acid is at least 500 nucleotides in length.

18. The unstructured nucleic acid of claim 11, wherein the unstructured nucleic acid is used in a ligase assay, a polymerase extension assay, or a nucleic acid array.

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